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AGRICULTURAL MEMORANDUM NO 507

Estimation of monthly rainfall totals - L P SMITH

An exercise was carried out to find the degree of error when the monthly rainfall (for a current year) at a site was estimated from the records of neighbouring stations. Two sets of three reporting stations from the MWR were chosen

(1) Stansted and Writtle were used to estimate for Earls Colne (30 km from Stansted and 25 km from Writtle) in relatively flat country.

(2) Huddersfield (Oakes) and Pontefract were used to estimate for Lister Park, Bradford (25 km from Oakes and 35 km from Pontefract) in relatively hilly country.

The annual averages for Earls Colne and Bradford were estimated from the large scale map, (50 km to the inch), as 600 mm and 890 mm respectively.

The monthly averages were found by applying the mean monthly percentages of annual total of the two neighbouring stations (the isometric).

Station		Stansted	Writtle	Mean	Earls Colne (49m) Averages (1916 - 1950)		
					Estimated	Actual	Error
Ht above MSL (metres)		101	32				
Percentage	Jan	9.2	9.3	9.2	55	61	-6
	Feb	6.5	6.9	6.7	40	41	-1
	Mar	6.0	6.1	6.1	37	37	0
	Apr	8.1	8.1	8.1	49	47	+2
	May	7.3	6.9	7.1	43	43	0
	Jun	6.7	6.4	6.6	40	40	0
	Jul	10.4	9.8	10.1	61	60	+1
	Aug	8.6	9.6	9.1	54	52	+2
	Sep	8.7	7.9	8.4	50	48	+2
	Oct	9.7	9.8	9.7	58	62	-4
	Nov	10.1	10.4	10.2	61	64	-3
	Dec	8.7	8.8	8.7	52	54	-2
					600	609	-9

With a mean error of 2 mm for the monthly averages, the method clearly gives results to a fair approximation. The average annual rainfalls at the three stations, namely 631, 593 and 609 mm are very much the same.

For current monthly totals (in millimetres) during 1971, the percentage of average at Earls Colne was assumed to be the mean of the percentages of average at Stansted and Writtle. The results were:

	Percentages of Average			Earls Colne		
	Stansted	Writtle	Mean	Estimated	Actual	Error
Jan	124	131	127.5	70	69	+ 1
Feb	29	27	28	11	22	-11
Mar	105	98	101.5	38	27	+11
Apr	77	58	67.5	33	21	+12
May	105	104	104.5	45	37	+ 8
Jun	193	241	217	87	85	+ 2
Jul	59	26	42.5	26	18	+ 8
Aug	154	91	122.5	66	61	+ 5
Sep	29	30	29.5	15	19	- 4
Oct	100	81	90.5	53	43	+10
Nov	105	115	110	67	79	-12
Dec	47	44	45.5	24	24	0
Year				535	505	+30

The mean error is 7 mm for the monthly estimates; individual errors as high as 12 mm may be admissible for some purposes.

Repeating the process for the three West Riding stations:

Station		Huddersfield	Pontefract	Mean	Bradford (134 m) Averages (1916 - 1950)		
					Estimated	Actual	Error
Ht above sea level		235	78				
Percentage	Jan	10.7	9.1	9.9	88	90	-2
	Feb	8.8	7.4	8.1	72	71	+1
	Mar	6.7	5.8	6.3	56	54	+2
	Apr	6.6	7.0	6.8	61	59	+2
	May	7.2	8.4	7.8	69	62	+7
	Jun	6.0	6.8	6.4	57	51	+6
	Jul	8.1	10.2	9.1	81	74	+7
	Aug	8.6	10.4	9.5	85	77	+8
	Sep	7.5	8.3	7.9	70	65	+5
	Oct	10.4	9.0	9.7	86	84	+2
	Nov	10.5	9.6	10.1	90	90	0
	Dec	8.9	8.0	8.4	75	78	-3
	Year				890	855	+35

The mean monthly error is 4 mm, the main source being the over-estimate of the annual average from the map.

The test for 1971 was as follows (rainfall in millimetres):

	Percentages of Average			Bradford		
	Huddersfield	Pontefract	Mean	Estimated	Actual	Error
Jan	56	66	61	54	57	- 3
Feb	86	29	57.5	41	62	-21
Mar	58	110	84	47	47	0
Apr	120	153	136.5	83	58	+25
May	89	109	99	68	77	- 9
Jun	139	117	128	73	73	0
Jul	99	70	84.5	69	40	+29
Aug	146	86	116	99	95	+ 4
Sep	24	36	30	21	17	+ 4
Oct	113	84	98.5	85	81	+ 4
Nov	81	72	76.5	69	56	+13
Dec	54	56	55	41	32	+ 9
Year				750	695	+55

The mean error per month is 10 mm, again partly due to the over-estimate of the annual average. Individual errors over 20 mm could be very misleading.

The average annual rainfalls at the three stations, 953, 593 and 855 mm cover a far larger range of climate than the three Essex stations.

Estimates for individual days can also be misleading, as the following comparison of maximum daily falls each month shows:

	Stansted	Writtle	Earls Colne	Huddersfield	Pontefract	Bradford
Jan	13	12	9	14	7	12
Feb	5	3	7	28	4	25
Mar	10	12	9	8	9	16
Apr	17	12	9	39	48	36
May	11	13	10	15	13	31
Jun	21	28	19	14	9	23
Jul	19	6	5	23	16	10
Aug	22	13	14	32	17	35
Sep	10	8	8	7	9	7
Oct	16	19	17	62	18	39
Nov	14	15	15	19	12	19
Dec	9	11	7	13	12	11

Any comments or suggestions on this paper should be referred to the author.

Meteorological Office
Bracknell

November 1972